CURRENT LITERATURE.

BOOK REVIEWS.

The mutation theory.[1]

CONTRIBUTIONS TO the theory of evolution have been many, but in these later years progress has been very slow, largely because philosophical speculations and acrid discussions have dominated facts. The chief value of this great work of De Vries is that it makes a constant appeal to experiment and careful observation. The volume before us is but half of his work, doubtless the more important half, since it contains the brilliant experimental work which has led the author to present to the world his theory of the origin of species. The second volume is to deal with the principles of hybridization.

The theory of mutation is not new. Darwin recognized it especially in his earlier works, holding that "single variations" or sports have to be reckoned with, as well as natural selection. Through the influence of Wallace and others, natural selection has in most quarters come to be the ruling theory, though the importance of other factors has frequently been emphasized. As long ago as 1864 Kölliker appealed to heterogenesis, which is identical with mutation; the term "mutation" has been used by Scott and various writers, and the term "saltatory evolution" has been used by still others. Mutation involves the sudden origin of a new species without transitions or connecting links. Not all natural selectionists would find fault with this, since Darwin fully recognized the fact that selection improves rather than creates. Some selectionists, however, have held that natural selection is in reality a creative force, and to such De Vries has little comfort to give. Indeed, he discards natural selection altogether, so far as the evolution of species is concerned. Numerous experiments by the author and others show that there is a definite limit to individual variability, and that the full advantage of selection along any one line can usually be obtained within a very few generations, as in the parsnip or carrot. Again he claims that selection never fixes a character, but that reversion occurs after any number of generations of culture; apparent exceptions to these principles are due to hybridization or mutation. Thus natural selection can never create anything new; it can improve only within definite and narrow limits, and this improvement is possible only in artificial conditions. Mutation, on

[1] DE VRIES, HUGO: Die Mutationstheorie. Versuche und Beobachtungen über die Entstehung von Arten im Pflanzenreich, Vol. I. 8vo, pp. 648, with eight colored plates and many text figures. Leipzig: Veit & Co., 1901. See also Rev. Gén. Bot. 13: 5–17. 1901.

the other hand, brings into existence something altogether new, the mutant remains fixed from the outset, and if it is fit, it will survive the struggle for existence as a new species. Mutability and variability are sharply contrasted; variability is obviously governed by external factors, especially nutrition, while mutability has no such obvious connection. Thus we may say that most species are fixed and immutable, yet more or less variable from their origin to their final extinction.

De Vries accepts Jordan's idea of species, viz., that within the Linnean species there may be "elementary species" (varieties, of authors), which are experimentally immutable. Jordan found about 200 immutable forms within the ordinary species limits of *Draba verna*; hence the idea that *Draba verna* is a collective group, and that the 200 immutable forms represent true species. In such cases the author favors a trinomial nomenclature.

Of a number of natural species studied, *Oenothera Lamarckiana* was the only one which appeared to be in a state of mutability. This species was found naturalized on a field near Hilversum, Holland, about 1875, and has increased its area rapidly. When first observed by De Vries in 1886, two elementary species were noticed among the normal forms, and were named by the author *Oenothera brevistylis* and *laevifolia*. Since that time these forms have maintained themselves, in spite of hybridization and the struggle for existence. From 1886 until now De Vries has made observations in the field at Hilversum, and has made almost innumerable cultures in the botanical garden at Amsterdam.

The experimental results may be briefly summarized. Out of 50,000 seedlings of *Oenothera Lamarckiana* in the various years of study, 800 or about 1.5 per cent., were mutants, while 98.5 per cent. came true to seed. Of these 800 mutants, more than one fourth belonged to the new species, *Oenothera lata*, *i. e.*, this species appeared anew in cultures more than 200 times; on the other hand *Oenothera gigas* appeared but once. From a great many other new species the author selected the most promising for further study. The new species have proved to be quite distinct from one another and from the parent species, not only in one but in several characters. De Vries shows in an exhaustive and satisfactory fashion that his new forms are as fully entitled to specific rank as any of the Onagra group of Oenothera (*e. g.*, *O. biennis*, *Lamarckiana*, *muricata*, *cruciata*, etc.). Indeed, it is possible to identify most of the species with certainty, as early as the rosette stage, some species having round and others grasslike leaves. The mutations are planless, occurring in all possible directions, involving all plant organs. Some of the mutants appear to have improved upon the parent forms, but in most instances this is not the case. The great majority of the mutants are constant from the outset; there is no fixation of their characters by selection, nor is there any reversion. There are no transitions between parent and offspring. One extremely interesting result is that the mutants

themselves show occasional mutations, and in many cases the same species has arisen from different parents. There follow theoretical considerations which may be omitted here, except to state that De Vries believes in periodic mutability, since most species now appear to be immutable. What causes mutability can only be conjectured; perhaps it is favored by generations of excellent nutrition, perhaps by alternations of diverse conditions.

About half of the first volume deals more indirectly with mutation. One section treats of nutrition and selection, another with the origin of garden varieties, the author finding general agreement in a number of cases with his work on Oenothera.

Independently and all but simultaneously with De Vries, Korschinsky[2] has brought together a vast mass of data under the title *Heterogenesis and Evolution*. From the records of gardeners and horticulturists, he has attempted to show that most of the culture "varieties" have arisen through heterogenesis and not by means of selection. Such evidence is not very trustworthy in special cases, but perhaps the mass of detail by its mere quantity may help to strengthen the case as a whole. In any event such evidence and the fact that it is brought forward independently gives support to the work of De Vries. Solms-Laubach[3] has presented evidence to show that *Capsella Heegeri* has arisen as a sport from *C. Bursa-pastoris*. Carlson[4] thinks similarly for some Swedish forms of *Succisa pratensis*. C. A. White[5] reports cases of mutation in the Acme tomato. In a most admirable paper on the present condition of our knowledge as to the origin of species, Wettstein[6] holds that several theories are tenable, but that among them all that of heterogenesis seems most important. He gives some of his own observations in support of this theory. Moll,[7] in an extended and highly appreciative review of De Vries's work, says that this is easily the most important work on evolution since Darwin's *Origin of Species*. Schumann[8] holds that this is the first work that has really established the evolution theory; he also accepts the Jordan-De Vries concept of species and the system of trinomial nomenclature.

It is much too early, of course, to venture a final opinion as to the true value of this work. That it is one of the greatest of all contributions to the literature of evolution is certain. That it will lead to a flood of experimental investigation is assured, and perhaps this will be the author's greatest service to the world. Whether natural selection has had its day, whether mutation is the dominant method of the origin of species, and whether Jordan's "ele-

[2] Flora **89**: 240–363. 1901.

[3] Bot. Zeit. **58**[1]: 167–190. 1900.

[4] Bot. Not. **1901**: 224–226.

[5] Science **14**: 841–844. 1901.

[6] Ber. Deutsch. Bot. Ges. **18**: Generalversammlungsheft 184–200. 1900.

[7] Biol. Cent. **21**: 257–269; 289–305. 1901.

[8] Bot. Cent. **87**: 170. 1901.

mentary species" will replace the "collective species" of Linnaeus are questions that must be left for the future to answer.—H. C. COWLES.

MINOR NOTICES.

EDGAR W. OLIVE has[9] published a preliminary enumeration of the Sorophoreae, in advance of a more extended paper on the Acrasieae and their allies. Twenty-five species are presented, only one member of the group having been heretofore reported from America. A new genus (*Guttulinopsis*) is characterized, containing three species, and five other new species are described.—J. M. C.

THE FOURTH FASCICLE[10] of the list of the genera of seed plants according to the Engler sequence has just appeared. The general character of the work was stated in this journal[11] in the notice of the first fascicle. In the present signature 1340 genera are listed, bringing the total number up to 5182. This fascicle begins with Dipteryx (Leguminosae) and ends with Cochlanthera (Guttiferae).—J. M. C.

THE SEVENTH PART of Engler's *Pflanzenreich* has appeared,[12] and contains the Naiadaceae (family 12 of the spermatophyte series), by A. B. Rendle. The preliminary discussion is in English, and deals with the vegetative organs, anatomy, floral structure, geographic distribution, etc. The single genus *Naias* is presented as including thirty-two species, *N. marina* comprising sixteen named varieties.—J. M. C.

PARTS 211 and 212 of Engler and Prantl's *Natürlichen Pflanzenfamilien* have appeared.[12] The former contains the Lepidodendraceae, Bothrodendraceae, Sigillariaceae, and Pleuromoiaceae, by H. Potonié, and the beginning of Isoetaceae by R. Sadebeck. It is interesting to note that in Potonié's scheme of phylogeny the Lepidodendraceae give rise to the Araucarieae, and these in turn to the other conifers. Part 212 contains the Dicranaceae, Leucobryaceae, Fissidentaceae, Calymperaceae, and Pottiaceae by V. F. Brotherus.—J. M. C.

OHIO FUNGI EXSICCATI, briefly noticed last month, are being issued in small fascicles by Professor W. A. Kellerman, of the Ohio State University. They are not sold, but distributed to mycological students and collectors making exchanges. The first fascicle, issued November 20, 1901, contains sixteen numbers, the specimens being ample and well packeted. Eight of these numbers belong to the Uredineæ, and the remainder to various para-

[9] Proc. Amer. Acad. **37**: 333–344. 1901.

[10] DALLA TORRE, C. G. DE, and HARMS, A.: Genera Siphonogamarum ad systema Englerianum conscripta. Fasciculus quartus (signatura 31–40). Small 4to, pp. 241–320. Leipzig: Wilhelm Engelmann, 1901. *M* 4.

[11] BOT. GAZ. **30**: 67. 1900.

[12] Press of Wilhelm Engelmann, Leipzig.